DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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September 21, 1994

The Honorable Victor H. Reis
Assistant Secretary for Defense Programs
Department of Energy
Washington, D.C. 20585

Dear Dr. Reis:

A Defense Nuclear Facilities Safety Board staff review team visited the Savannah River Site on July 26-27, 1994, and focused on the F-Canyon safety envelope. They noted that significant progress has been made in developing and validating the safety envelope management database that will link safety requirements contained in authorization basis documents to implementing procedures.

The enclosed report is a synopsis of the observations made during the review and is forwarded for your information.

Sincerely,

John T. Conway
Chairman

c: The Honorable Tara O'Toole, EH-1
Mr. Mark Whitaker, Acting EH-6
Dr. Mario Fiori, Manager SR Operations Office

Enclosure

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

August 9, 1994

MEMORANDUM FOR: G. W. Cunningham, Technical Director

COPIES: Board Members

FROM: David C. Lowe

SUBJECT: Savannah River Site (SRS) - F-Canyon Safety Envelope Review Trip Report (July 26-27, 1994)

1. **Purpose:** This trip report documents the Defense Nuclear Facilities Safety Board (DNFSB) technical staff (D. Lowe and J. Roarty) July 26-27, 1994, follow-up review of the F-Canyon safety envelope.

2. **Summary:** Significant progress has been made by the Westinghouse Savannah River Company (WSRC) in developing and validating the safety envelope management database that will link safety requirements contained in authorization basis documents to implementing procedures.

3. **Background:** This review was a follow-up to a review conducted June 6-8, 1994. The issues from the June review were forwarded to the Department of Energy (DOE) in a Board letter dated June 29, 1994. The July review was based on discussions with DOE Savannah River Operations Office (DOE-SR) and WSRC personnel.

4. **Discussion:**

   a. Safety Envelope Management: WSRC reported the status of their computer-based database that will link the requirements contained in the authorization basis documents and the safety-related systems procedure to the implementing procedures, surveillances, calibrations, and functional tests. This database will be used by the appropriate operations and engineering personnel to ensure that requirements contained in the authorization basis are met. The database is nearing completion and is also undergoing a verification and validation process. Significant improvements and progress have been made since our June review.

   The appropriate operations personnel (i.e., shift manager and shift technical engineer) are undergoing training and then engineering personnel (i.e., system engineers) will be trained to use the database.

   b. Authorization Basis Documentation: Revised Safety Analysis Report (SAR) Addendum 2 and Basis for Interim Operation (BIO) documents were prepared by WSRC and are still undergoing DOE-SR and DOE headquarters (DOE-HQ) review. The following

Unreviewed Safety Questions (USQs) are recommended for closure by WSRC based on the analyses documented in the revised BIO and SAR Addendum 2.

- Organic-nitrate uncontrolled reactions
- Hydrogen deflagration (radiolysis)
- Am-Cm solution source term and potential accidents
- Cooling tower airborne release pathway
- Tank siphoning event

c. Hydrogen Deflagration Accident: The primary safety measure to protect against a hydrogen deflagration is dilution of hydrogen with air using the process vessel vent system, dissolver offgas system, and canyon exhaust system. The following issues remain open:

1. The F-Canyon safety-related systems procedure (SOP 221-F-51230) has a requirement for a 0.01 inch water gauge pressure differential between the canyon and the process vessel. Depending on the location of the pressure readings, this pressure differential may not be sufficient to ensure adequate dilution airflow into the process vessel via the overflow line. Installation of the differential pressure instrument is in progress, but the WSRC personnel present during the discussion were not aware of the specific location where the pressure readings will be taken. The DNFSB staff considers this a Phase I startup issue.

2. There is no procedure for an extended loss of process vessel ventilation to ensure that flammable levels are not reached in a process vessel. The worst case is Tank 17.1 which could reach the LFL in 5.8 hours. The DNFSB staff considers this a Phase I startup issue.

3. The Technical Standards require a minimum dissolver offgas flowrate to provide air dilution of the hydrogen produced during the cladding removal and dissolving process. The minimum flowrate is based on calculations using experimental data from the 1950s. A better alternative for ensuring that a flammable limit is not exceeded would be to install a flammable gas monitor. WSRC stated that a previous upgrade program to install a flammable gas monitor was cancelled and stated that such an installation would not be difficult. WSRC stated that they would reconsider installation of a flammable gas monitor. The DNFSB staff considers this a Phase II startup issue.

d. Other Issues: The following issues were previously raised and the current status is provided below:

1. WSRC indicated that the automatic diversion of cooling water upgrade is scheduled to be complete by January 1995.

2. Process vessel agitation will be verified prior to additions and transfers to certain process vessel by three indications (two of them independent):

   - Changes in specific gravity readings (if tank level is sufficient)
   - Agitator run light illumination
   - Agitator motor current indication

   If any of these are not available then the addition or transfer cannot take place, and if any of these indications are lost then the transfer is immediately secured.

3. Fauske & Associates, Incorporated recently completed organic-nitrate reaction experiments to determine the required vent area to prevent process vessel overpressurization. WSRC used this information to conclude that the process vessel vent area is adequate, but in order to ensure sufficient margin, an additional nozzle would be opened to provide additional venting for 21 process vessels. It was not clear how configuration control would be maintained to ensure that these nozzles remain designated for venting.

4. The Evaporation Technical Standard (DPSTS-221-FC-400) has been changed to reflect a hydrogen concentration limit that corresponds to 25% of the lower flammability limit (LFL). This change is undergoing DOE-SR and WSRC review.

5. The Savannah River Technology Center (SRTC) completed a statistical analysis of the remaining useful life of process vessels. The results indicate a high "infant mortality" bias. For example, the average life for failed batch evaporator coils is 4.6 years, while the average life for all batch evaporator coils is 22.3 years. WSRC stated that the analysis indicates that if the process vessel coil survives an initial use period it should have a long life. WSRC concluded that no further action is necessary for the process vessel coils (i.e., three evaporator coils that were installed in 1990-92) which statistically have a 70% probability for failure during the current operating mission.

6. Process vessel cooling/heating coil failure is similar to steam generator tube failure at pressurized water reactor power plants. A remote inspection system has been developed to allow periodic inspection of steam generator tubes. Application of a similar system may be feasible and worthwhile for inspection of canyon process vessel cooling/heating coils. WSRC stated that they would evaluate the potential for such a system.

5. **Future Actions:** The staff will perform follow-up reviews when DOE/WSRC actions are complete.